Planetary Magnetic Fields

Overview: You're going to use a compass to figure out the magnetic lines of force from a magnet by mapping the two different poles and how the lines of force connect the two. A magnetic field must come from a north pole of a magnet and go to a south pole of a magnet (or atoms that have turned to the magnetic field.)

What to Learn: Compasses are influenced by magnetic lines of force. These lines are not necessarily straight. When they bend, the compass needle moves. The Earth has a huge magnetic field. The Earth has a weak magnetic force. The magnetic field comes from the moving electrons in the currents of the Earth's molten core. The Earth has a north and a south magnetic pole which is different from the geographic North and South Pole.

Materials

- Bar magnet
- Horseshoe magnet
- Circular (disk) magnet
- Compass
- String
- Ruler

Experiment

1. Tie a string around your magnet.
2. Bring it close to the compass.
3. Which end is the north end of your magnet? Label it with a pencil right on the magnet.
4. Flip the magnet around by twisting the string so that the compass flips to the opposite pole. Label the opposite site of the magnet with the appropriate letter (N or S).
5. Bring a second magnet close to the first one. What happens when you bring two opposite poles together? What if the poles are the same?

Now untie or cut the string for the next part of your lab.

6. Lay a piece of paper on your desk.
7. Place the magnet in the middle of the paper and trace the outline.
8. Draw 12 dots (just like on a clock) all the way around the magnet. These are the locations where you will place your compass, so make sure that they are close enough to the magnet so the magnet influences the compass.
9. Place your compass on one of the dots and look at the direction the arrow is pointing. Remove the compass and draw that exact arrow direction right over your dot. Do this for all 12 dots.
10. Draw another ring of dots an inch or two out from the first ring and repeat step 9.
11. Repeat steps 6-10 with a circular magnet on a new sheet of paper.
12. Repeat steps 6-10 for the horseshoe magnet on another sheet of paper.

Reading

Right under your feet, there's a magnet. Go ahead take a look. Lift up your feet and see what's under there. Do you see it? It's huge! In fact, it's the largest magnet on the Earth. As a matter of fact, it is the Earth! That's right; the Earth is one huge, gigantic, monolithic magnet! We're going to use a magnet to substitute for the Earth and plot out the magnetic field lines.

The magnetic pole which was attracted to the Earth's North Pole was labeled as the *Boreal* or "north-seeking pole" in the 1200s, which was later shortened to "north pole." To add to the confusion, geologists call this pole the North Magnetic Pole.

Exercises

1. How are the lines of force different for the two magnets?

2. How far out (in inches measured from the magnet) does the magnet affect the compass?

3. What makes the compass move around?

4. Do you think the compass's *north-south* indicator is flipped, or the Earth's North Pole where the South Pole is? How do you know?

Answers to Exercises: Planetary Magnetic Fields

1. How are the lines of force different for the two magnets? (Since this is going to depend on the kind of magnets you use, refer to the data collected.)

2. How far out (in inches measured from the magnet) does the magnet affect the compass? (Since this is going to depend on the kind of magnets you use, refer to the data collected.)

3. What makes the compass move around? (The magnetic lines of force that are invisible to your eye.)

4. Do you think the compass's *north-south* indicator is flipped, or the Earth's North Pole where the South Pole is? How do you know? (It's an arbitrary denotation, but the Earth's North Pole is deemed to be north.)